

Contents

Preface to the second edition	ix
Preface to the first edition	xi
Abbreviations	xiv
1 Introduction	1
1.1 What is a wetland?	1
1.2 Wetland classification	6
1.3 Wetland inventories	9
1.4 Summary	11
1.5 Practical experiments and observations	11
1.5.1 <i>Wetland classification</i>	12
2 Water and Soil	13
2.1 Physical and chemical properties of water	14
2.2 Wetland hydrology	22
2.3 Secondary gradients	31
2.4 Hydric soils	33
2.4.1 <i>Soil genesis</i>	33
2.5 Summary	41
2.6 Practical experiments and observations	42
2.6.1 <i>Water levels</i>	42
2.6.2 <i>Water chemistry</i>	43
2.6.3 <i>Temperature and oxygen gradients</i>	43
2.6.4 <i>Redox</i>	43
2.6.5 <i>Hydric soils</i>	44
3 Microorganisms and Invertebrates	45
3.1 Microorganisms	46
3.1.1 <i>Bacteria</i>	47
3.1.2 <i>Fungi</i>	49
3.1.3 <i>Algae</i>	51
3.2 Invertebrates	55
3.2.1 <i>Aquatic insects</i>	56

3.3	Summary	65
3.4	Practical experiments and observations	65
3.4.1	<i>Wetland algae</i>	65
3.4.2	<i>Wetland invertebrates</i>	66
4	Wetland Plants and Animals	69
4.1	Wetland plants	71
4.1.1	<i>Internal gas-space continuum</i>	77
4.1.2	<i>Heterophylly</i>	84
4.1.3	<i>Clonal growth</i>	87
4.2	Birds	89
4.3	Fish	94
4.4	Amphibians, reptiles, and mammals	98
4.5	Summary	103
4.6	Practical experiments and observations	103
4.6.1	<i>Macrophyte adaptations</i>	103
4.6.2	<i>Seed banks</i>	104
4.6.3	<i>Wetland birds</i>	105
4.6.4	<i>Wetland fish</i>	105
5	Spatial and Temporal Patterns	106
5.1	Coenoclines	106
5.2	Spatial patterns	110
5.2.1	<i>Coenocline development</i>	113
5.2.2	<i>Fire</i>	119
5.3	Temporal patterns	119
5.3.1	<i>Macro-succession</i>	119
5.3.2	<i>Micro-succession</i>	122
5.3.3	<i>Micro-succession versus fluctuations</i>	126
5.4	Development of wetland landscapes	128
5.5	Summary	131
5.6	Practical experiments and observations	133
5.6.1	<i>Gradient analysis</i>	133
5.6.2	<i>Sediment cores</i>	134
6	Wetland Functions	135
6.1	Primary production	136
6.2	Food webs	145
6.3	Litter decomposition	153
6.4	Nutrient cycling	159
6.4.1	<i>The carbon cycle</i>	160

6.4.2	<i>Nitrogen and sulfur cycling</i>	165
6.4.3	<i>Phosphorus cycling</i>	167
6.5	Summary	169
6.6	Practical experiments and observations	170
6.6.1	<i>Primary production</i>	170
6.6.2	<i>Invertebrates and litter decomposition</i>	170
6.6.3	<i>Methane production</i>	171
7	Invasive Species	173
7.1	What makes a species invasive?	175
7.1.1	<i>Landscape sink or disturbance hypothesis</i>	175
7.2	Superior competitor hypothesis	177
7.2.1	<i>Enemy release</i>	177
7.2.2	<i>Broader tolerance</i>	178
7.2.3	<i>Efficient use</i>	179
7.2.4	<i>Hybrid vigor</i>	180
7.2.5	<i>Allelopathy</i>	181
7.2.6	<i>Empty niche</i>	181
7.2.7	<i>Invasive animal species</i>	182
7.3	What effect do exotic species have on wetlands?	186
7.4	What should be done to control invasive species?	189
7.5	Summary	192
7.6	Practical observations	193
8	Restoration and Creation	194
8.1	Definitions	194
8.2	Restoration and succession	199
8.3	Environmental restoration	201
8.4	Biological restoration	202
8.4.1	<i>Plant materials</i>	203
8.4.2	<i>Invasive species</i>	205
8.4.3	<i>Suitable establishment conditions</i>	206
8.5	Restoration planning	206
8.5.1	<i>Project goals</i>	207
8.5.2	<i>Site selection and evaluation</i>	209
8.5.3	<i>Restoration plan</i>	211
8.5.4	<i>Implementation</i>	211
8.5.5	<i>Monitoring</i>	212
8.5.6	<i>Project evaluation and management</i>	212
8.6	How successful are wetland restorations?	214
8.7	Post-project management	216
8.8	Summary	216

9	Global Climate Change	218
9.1	Wetlands and the global carbon budget	219
9.2	Impacts of climate change	224
9.2.1	<i>Species composition</i>	225
9.2.2	<i>Migration and extinction</i>	227
9.3	Indirect effects	228
9.3.1	<i>Prairie potholes</i>	231
9.3.2	<i>Louisiana coastal marshes</i>	232
9.4	Summary	239
9.5	Practical experiments and observations	240
10	The Value and Future of Wetlands	241
10.1	Functions, services, and values	243
10.2	Protection and conservation	249
10.3	Future of wetlands	253
	Glossary	255
	Bibliography	259
	Index	275